

(MABI 1999)



## PART 4: DESCRIPTION OF THE MOUNT TOM FOREST

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## PART 4: DESCRIPTION OF THE MOUNT TOM FOREST

This chapter examines the physical composition and current management of the Forest to provide background on the resources that could be affected by implementing each of the alternatives described in Section 3.2. This includes a review of the Forest's historical significance; descriptions of cultural landscape and ecological characteristics; summaries of educational programs and visitor use; and overviews of the Park's current sustainable management practices, connections with the surrounding community, and adaptive management programs.



From top: View west from the South Peak (Laura A. Cohen 2004); painted turtles at The Pogue (Tom Lautzenheiser 2002); Park ranger and visitors around a Norway spruce (MABI 2003); dry-laid stone causeway south of The Pogue (OCLP 2003).

## 4.1 CULTURAL RESOURCES AND HISTORICAL SIGNIFICANCE

### 4.1.1 HISTORIC SIGNIFICANCE

Historical significance is the ability of a property to convey its importance through physical attributes. In accordance with the National Register of Historic Places criteria, significance is manifested in a property through its historical association with events that have contributed to the broad patterns of American history (Criterion A), through association with persons significant in history (Criterion B), through physical traits that embody distinctive characteristics of design (Criterion C), or through its ability to yield information in prehistory or history (Criterion D).

The Park was established to recognize and interpret the significance of the Billings Estate in the history of American conservation and individuals significant in that history, including George Perkins Marsh, Frederick Billings, and Laurance S. Rockefeller. The Park's legislation recognized Frederick Billings' pioneering conservation stewardship of the property founded on principles introduced by Marsh, as well as the remarkable continuity of conservation stewardship carried forward over the ensuing century by Billings' wife and heirs, and Mary and Laurance S. Rockefeller. Research undertaken since the Park was established has identified additional areas of significance for the property related to landscape architecture and agriculture. Together, these areas of significance span a period beginning with Marsh's birth in 1801 through the end of Laurance S. Rockefeller's residency on the property in 1997.

The character of the Forest clearly contributes to the significance and integrity of the property in the areas of conservation, landscape architecture, and agriculture.<sup>1</sup> Overall, the Forest contributes to the integrity of the property in its location, design, setting, materials, workmanship, feeling, and association. While the overall character of the landscape most clearly demonstrates Rockefeller-era management practices, many features also illustrate significance related to the following historic associations: pioneering reforestation practices; forestry practices of the early and mid-twentieth century; model (gentleman's) farms; and late-nineteenth-century landscape design. The following three sections identify the key characteristics of the Forest that convey these areas of historic significance.

#### 4.1.1.1 American Conservationists (Criterion B)

**George Perkins Marsh:** The property is significant in the history of conservation through its association with George Perkins Marsh, a pioneering American conservation philosopher who was born on the property in 1801, and whose family farm it remained through 1869. The Mansion Grounds and the eastern half of the Forest, including The Pogue, comprised what was the Marsh Place.

In order to convey historic significance, the property must retain historic integrity. Aspects of historic integrity include:

- **Location:** the place where the historic property was constructed or the historic event occurred
- **Design:** the combination of elements that create the form, plan, space, structure, and style of a property (e.g., the design of the carriage road system, views and vistas, The Pogue, etc.)
- **Setting:** the physical environment of a historic property
- **Materials:** the physical elements of a particular period, which include plant materials, paving, and other landscape features (e.g., species selected for forest plantations, stone used for retaining walls, cultivated regeneration, etc.)
- **Workmanship:** the physical evidence of the crafts of a particular period (e.g., forestry techniques of different periods, stonework along carriage roads, etc.)
- **Feeling:** a property's expression of the aesthetic or historic sense of a particular period (e.g., sense of an actively managed forest, nineteenth-century landscape design, a well-maintained country estate, etc.)
- **Association:** the direct link between an important historic event or person and a historic property.



George Perkins Marsh. (Library of Congress)

Defining landscape characteristics are those prominent or distinctive aspects, qualities, or characteristics of the Forest that contribute significantly to its historic character. Such characteristics may include landscape patterns, forest management practices, vegetation, materials, and designed elements. In other cultural landscape references, these may also be known as “character-defining features” (NPS 1996).



Top, Frederick Billings (1873); bottom, Laurence and Mary Rockefeller (c.1980s). (MABI)

Defining landscape characteristics and features related to the Marsh era include field boundaries, legacy trees and groves, and the old farm road that leads to The Pogue.

**Frederick Billings:** The property is significant in the history of conservation through its association with Frederick Billings, a Vermont native, captain of industry, and pioneer conservation practitioner who expanded the Marsh Place into a country estate and model farm between 1869 and his death in 1890. Billings developed a pioneering forestry program to address major conservation imperatives of utility, aesthetics, and recreation. Overall, the current composition and character of the Forest was strongly influenced by Billings’ vision and forestry work. Although the Forest had a more open and agricultural character during his lifetime and had a heavier emphasis on utility (agricultural and timber production), many of the defining landscape characteristics of Billings’ work remain. These include the carriage road system and associated features, designed views and vistas, the Woodbarn, The Pogue, plantations around the Mansion Grounds and French Lot, and managed hardwood and mixed forest stands.

**Laurance S. Rockefeller:** The property is significant in the history of conservation through its association with Laurance S. Rockefeller, a noted conservationist of the mid-twentieth century, who along with his wife, Mary French Rockefeller, granddaughter of Frederick Billings, continued to manage the Forest in conjunction with Billings Farm, Inc. from the late 1950s through the 1990s. The Rockefellers maintained the Forest much as Frederick Billings and his wife and daughters had developed it, combining utilitarian forestry with aesthetics and recreation. The Forest strongly evokes Laurance S. Rockefeller’s concept of “Conservation for People,” in which he sought to balance environmental preservation, then gaining widespread support in the mid-twentieth century, with responsible use. Believing much as Marsh and Billings had that nature could be improved, Rockefeller hired a professional forester to manage the Forest to enhance its aesthetic and recreational value by continuing active management to maintain views, thin conifer plantations and hardwood and mixed forest stands, expand recreational infrastructure, and generally create a well-tended appearance. Wood continued to be harvested from the Forest for firewood, veneer, utility poles, pulp, and dimensional wood. Defining landscape characteristics of the Forest associated with Laurance S. Rockefeller include the continuity and expansion of the carriage road and trail system, designed views and vistas, and managed plantations and hardwood and mixed forests.

#### 4.1.1.2 American Conservation Movement (Criterion A)

**Pioneering Nineteenth-century Forestry (1874 – 1910):** The Forest is significant in the history of conservation as a pioneering example of scientific forestry, begun by Frederick Billings in 1874 and developed into the first decade of the twentieth century prior to the institutionalization of the American forestry profession. Billings initiated his forestry program at a time that coincided with

the earliest private and public efforts to address conservation through forestry and reforestation in particular: one year after the first federal reforestation act was passed, one year before the founding of the American Forestry Association, two years before the arrival of the first professional forester in America, and over fifteen years before the first widely acknowledged professional forestry program was begun on the Vanderbilt Estate at Biltmore, North Carolina.

After 1884, Billings was assisted by his semi-professional farm manager, George Aitken, who continued the estate's reforestation program through 1910 as state governments throughout the Northeast were instituting parallel programs. Both Frederick Billings and George Aitken played key roles in the development of the State of Vermont's forestry program. The Billings Estate was also recognized in the early twentieth century in Vermont and in other New England states as a model of reforestation, primarily due to its early plantations that were some of only a few examples that had sufficiently matured by that time to provide forestry experts with tangible evidence of the benefits of reforestation.

While the Forest has changed considerably over the past 100 years, it retains many defining landscape characteristics related to pioneering nineteenth-century forest management. The early record of forestry practice on the property is most clearly conveyed through intact plantations set out by Frederick Billings and George Aitken between about 1874 and 1910 (including three on the Mansion Grounds and three along the French Lot), and the infrastructure for forestry work that includes the carriage road system and the Woodbarn and its adjoining work yard.

*An Example of Continuous Forest Management (1910 – 1997):* The Forest is significant in the history of conservation as a representative example of developments in American forestry practice from the early twentieth century to the end of the Rockefeller era in 1997. Following the pioneering work carried out on the property from the 1870s through about 1910, Frederick Billings' wife and daughters continued the reforestation program through about 1952, continuing to balance utility with aesthetics and recreation. The forest plantations remaining from this period (six from the 1910s, two from the 1930s, and two from the 1950s) are representative of the fulfillment of Frederick Billings' pioneering practices as reforestation became institutionalized and widely practiced in the first decade of the twentieth century throughout the Northeastern states.

In Vermont, this institutionalization included the establishment of a state tree nursery and appointment of the first forest commissioner in 1906, the establishment of the first state forest in 1909, and the beginning of the state's reforestation work in 1910. By the 1920s and 1930s, reforestation had become widely acknowledged throughout the state as one of the best means to solve the economic problems of rural communities, with over 27,000,000 trees planted in the Vermont by the late 1930s.

Following a lull during the Second World War, reforestation in Vermont and throughout the Northeast reached an annual high during the 1950s, but by the mid-1960s it had declined significantly in response to public demand for preservation of open spaces and the establishment of wilderness preserves where trees would not be harvested. This decline in reforestation was also evident in the Mount Tom Forest: planting ceased after about 1952 and forest management transitioned to maintaining and enhancing the health and productivity of the plantations and naturally regenerated hardwood and mixed forest stands.<sup>2</sup> During this period “multiple-use” forest management was broadly advocated and practiced within the forestry profession. The approach sought to integrate forest productivity with other management values such as recreation, ecological health, and aesthetics.

The changes in the forestry profession echoed Laurance Rockefeller’s philosophy of “Conservation for People” and his pragmatic approach to management, which favored the integration and balance of multiple values including aesthetics, ecological protection, and historic preservation. During the Rockefeller period, the Forest continued to operate under the Vermont Tree Farm System; a professional forester, John Wiggin, was hired to assist with the stewardship of the property; wood continued to be grown and harvested; and recreational activities were expanded.

These management activities are responsible for the character of the plantations and hardwood and mixed conifer stands as they exist today. Without it, forest stands would have become overcrowded, forest health would have suffered, and many trees would likely have died or been lost during natural disturbances such as wind and ice storms.

The character of the plantations and hardwood and mixed conifer stands as they exist today convey their association with the height of plantation forestry as a conservation practice during the first half of the twentieth century, and the changes in forestry practices through the later half of the century. Other defining landscape characteristics related to the Forest’s association as an example of continuous forest management include recreational trails, vista clearings, forestry skid trails, and remnant log landings.

#### **4.1.1.3 Agriculture and Landscape Architecture (Criterion C)**

*Late Nineteenth-century Model Farm:* Together with the Mansion Grounds and Billings Farm & Museum, the Forest is significant in the area of agriculture as a representative component of a late-nineteenth century model (gentleman’s) farm that includes agricultural land, managed forests, and a forest park developed for demonstrational, utilitarian, aesthetic, and recreational purposes. The property also contains remnants of some of the vernacular farms that Billings purchased and incorporated into his estate. Such remnants include stone walls, roads, and legacy trees. The overall character of the Forest as a component of a model farm

remains intact, with the exception of the conversion of many of the working agricultural fields to forest.

**Landscape Design During the Country Place Era:** The Forest is significant in the area of landscape architecture as a distinctive example of landscape design during the Country Place Era (1870–1930), illustrating late-nineteenth-century interest in the picturesque. Billings’ interest in the picturesque and his vision for the estate was informed, in part, by his association with Robert Morris Copeland and other landscape architects of the time. The aesthetic sensibilities of the Country Place Era are represented in the Forest by its network of carriage roads and trails; rustic bridges, culverts, and walls; views and vistas; placement of some of the plantations; and creation of The Pogue. These features are largely unchanged from their original design. The overall character of the Forest as an example of late-nineteenth-century landscape design remains largely intact.

#### 4.1.2 LANDSCAPE CHARACTER

As a rural landscape encompassing more than 500 acres, the Forest’s large-scale patterns, such as landforms, fields, streams and seeps, road corridors, forest edges, and diverse forest architecture, are dominant characteristics. Yet because it is also a designed landscape and managed forest, details in the Forest such as the tree species, planting patterns, and even-aged character of plantations; vista clearings; the construction of The Pogue; and the alignment, surface materials, and masonry structures of the carriage roads, are also significant. Together with the broad patterns, these details are key to illustrating the property’s significance in the areas of conservation, agriculture, and landscape architecture. The key landscape characteristics can be grouped into three broad categories: spatial organization, circulation, and vegetation.

##### 4.1.2.1 Spatial Organization

The historic character of the Forest is defined by a mosaic of spaces formed by the interrelationship of hills and valleys, road corridors, naturally regenerated and planted forest stands, fields, The Pogue, and vista clearings. As discussed in Section 2.2, this patch-like character reflects the results of over 135 years of continuous forest management, the agricultural origin of the landscape, and the influence of late-nineteenth-century landscape design. The spatial organization of the landscape largely reflects the evolution of land use into the mid-twentieth century, as agriculture and reforestation declined. The Rockefellers subsequently maintained the extant patchwork of forest and field. Key features and characteristics that comprise the landscape patchwork and spatial character of the Forest include:

- **Road corridors:** These illustrate the integration of utility, recreation, and aesthetics that were key to Frederick Billings’ conservation practices. The road corridors are primarily enclosed within the forest canopy, except



Top, trail on north side of Elm Lot;  
bottom, carriage road on east side of  
Elm Lot. (OCLP 2003)



From top: Remnant stone walls identify former field and pasture edges; vista clearing looking north from the North Ridge Road; view looking south from the French Lot. (OCLP 2003, 2004)

alongside meadows, at vista overlooks, or around The Pogue. On many main roads, corridors were managed by the Rockefellers to maintain a well-tended appearance and allow views into the forest and to natural features such as streams through thinning of the understory. Public roads, including Elm Street on the east and Prosper Road on the west, provide discernable edges and primary fronts to the Forest, lined primarily by intact conifer plantations.

- **Fields:** These represent the historic development of the Forest as an agricultural property, and form the dominant open spaces within the Forest. Typically covering gently rolling or sloping ground around The Pogue, the fields were maintained by the Rockefellers with clearly defined forest edges. They were maintained with a generally uniform character either through grazing or mowing.
- **Forest:** Unlike a natural forest, the Mount Tom Forest has a complex spatial character due to its wide variety of stands that reflect a long period of management and former agricultural land use. The variety of stands imparts a diverse spatial quality to the interior of the Forest, ranging from open understory and high canopy (such as in the intact conifer plantations and mature woodlots) to enclosed through heavy undergrowth and mixed age structure (such as in younger woodlots and naturalized plantations). Traces of lost spatial character are evident in the Forest through stonewalls that once lined fields and pastures, as well as by the boundaries of plantations that often correspond with the limits of old fields.
- **Vista clearings:** These provide spatial and visual connection from the Forest to the surrounding countryside. Along with the carriage roads, vista clearings contribute to the significance of the Forest in the area of landscape architecture. The vista clearings are all small openings that were maintained in the Forest at topographic highpoints, except for the French Lot Overlook. This overlook offers a broad view to Mount Ascutney through an open field that is intentionally framed by two mature conifer plantations.

#### 4.1.2.2 Circulation

The historic character of the Forest is defined in large part through a circulation system that connects the mosaic of spaces and provides the primary way of experiencing the landscape. The roads and trail system was conceived by Frederick Billings in 1869 and expanded by his heirs through about 1914, with additional recreational components added under the Rockefellers through the 1990s. It illustrates the combined utilitarian and recreational/aesthetic characteristic of conservation practices during those periods, as well as aspects of late-nineteenth-century landscape design. The roads and trails have been open for public use since Frederick Billings' day. Overall, it retains the defining characteristics that were present during the Billings era, and reflects additional recreational use of the Forest under the Rockefellers. Key features and

characteristics of the circulation system in the Forest include:

- **Carriage roads:** The network of carriage roads that weaves through the Forest was designed for both utilitarian and recreational purposes, and represents a key component of the designed landscape. Built partially upon the alignment of earlier farm roads (incorporating some early structures such as retaining walls and culverts), the carriage roads feature winding alignments following the natural topography, broad corridors, rustic stone structures, graded gravel/earthen surfaces, extensive drainage systems, and overlooks. Most of the system remains intact within the boundaries of the Park, except for sections of three roads that extend onto adjoining properties. Along the roads are rustic log benches, stone water troughs, and wood directional signs that primarily reflect the historic recreational use of the Forest.
- **Skid roads:** Several roads were built and/or maintained as secondary circulation features primarily for utilitarian forestry and agricultural purposes during the Rockefeller era and perhaps before. These were generally characterized by two tracks in an earthen surface through narrow corridors, without significant grading or major built features. Skid roads revegetate if they are not continually maintained. It is likely that other skid roads existed on the property during different times and that the layout of skid roads has changed in response to the location and type of forestry work occurring throughout the property. The existing pattern of skid roads reflects the utilitarian forestry work that occurred during the Rockefeller era.
- **Trails:** The network of trails, built for pedestrian and equestrian purposes, represents the importance of recreation in the Forest, most notably increased recreational use under the Rockefellers. The trails in part parallel the carriage roads and also access difficult terrain and topographic highpoints. They typically consist of single earthen tracks through narrow clearings in the forest, include some minor grading and stone walls, and in several cases access overlooks. The cross-country ski trail system was established by the Woodstock Resort Corporation in 1977 by adding a number of new trails to the property and grooming existing carriage roads, skid roads, and hiking trails. Some of the trails are former skid roads that were maintained or upgraded for recreational purposes and are characterized by their wider clearings and limited use of built drainage features. Several trails are no longer actively used or managed, and are thus disappearing.

#### 4.1.2.3 Vegetation

Vegetation not only dominates the forest landscape, but also most clearly conveys the significant role of the Forest in the history of reforestation (both through plantations and natural succession) and forest management in American conservation practice through the mid-twentieth century. As discussed in Section 2.2, the plantations and hardwood forest stands, and the associated evidence of



From top: Intersection of two carriage roads (OCLP 2003); skid road off of the McKenzie Road (MABI 2004); typical cross-country/hiking trail (OCLP 2003); hiking trail with low stone wall (OCLP 2003).

management activities, strongly convey the Forest's historic associations. Indeed, the maturation of both forest stands and individual trees impart a strong sense of age and continuity to the landscape. Overall, the Forest retains its historic character related to conservation and forestry practice through the twentieth century. Key features and characteristics of the Forest's vegetation include:



Top, Norway spruce plantation near the McKenzie Farm; bottom, big-tooth aspens and sugar maples in Stand #23. (OCLP 2003)

- **Plantations:** These illustrate a continuum of reforestation practice from the 1870s through the 1950s, representing the beginnings and maturation of American conservation practice. Through their designed attributes, several plantations also contribute to the significance of the property in the area of landscape architecture. The earliest plantations set out by Frederick Billings and George Aitken through 1910 generally retain sufficient materials and elements to reflect the original planting patterns and thus illustrate their association with pioneering reforestation practices. Plantations set out between 1910 and 1954 generally retain characteristics related to their association with forestry practices of the period and the continuum of reforestation work undertaken on the estate through the 1950s. Several from this later period represent the only completely intact plantations within the Forest. All of the plantations exhibit evidence of continual thinning and forest management. However, due to decades of management and natural succession, a few plantations are less distinguishable from the surrounding northern hardwood forest and no longer convey their original planting pattern or species composition.
- **Northern hardwood and mixed forests:** Along with reforestation (plantations), hardwood and mixed forest stand management was a key component of the forestry program established by Frederick Billings in the 1870s and carried on by his wife and daughters and Mary and Laurance S. Rockefeller. Compared to the plantations, hardwood and mixed forest management typically had a more subtle, but still noticeable, impact on the character of the landscape. Annual harvest using single-tree and group selection were conducted removing quantities of firewood, veneer, pulp, and dimensional lumber. This management resulted in distinguishable patterns, such as greater spacing between trees, stumps in various stages of decay, skid trails with the occasional “bumper” trees along their edge, and trees with fewer defects, wounds, and signs of disease. These stands retain their overall character related to forest management practices prominent from 1910 to 1997, primarily those related to the Rockefeller era (1954–1997). Additionally, the patchwork of forest stands, and distribution of tree species and age classes illustrate the property's continuity of forest management.
- **Legacy trees, groves, and allees:** In addition to the plantations and woodlots, there are legacy trees, groves, and allées that illustrate traces of lost character as well as aspects of the Forest's designed and agricultural landscape. Among the oldest are several 300–400-year-old hemlocks that may be remnants

from the prehistoric forest. Throughout the plantations and woodlots are large trees with massive, spreading lower branches that convey the open agricultural origins of the landscape dating as far back as the late eighteenth century. Some of these trees are clustered in groves, such as the oak grove retained by Marsh family on the south hillside west of their home. Rows of trees, particularly sugar maples, line old farm roads as well as roads built by Frederick Billings and his heirs as part of the designed landscape. Others are remnants of hedgerows and fence lines.

#### 4.1.3 ARCHEOLOGICAL RESOURCES

Archeological resources are the remains of past human activity and the records documenting the scientific analysis of those remains.<sup>3</sup> An archeological site(s) can be eligible to be listed in the National Register of Historic Places if the site(s) has yielded, or may be likely to yield, information important in prehistory or history. Archeological sites contribute to the significance of the Mount Tom Forest. An Archeological Overview and Assessment is currently being conducted by the University of Vermont Consulting Archeology Program. Preliminary results indicate that there are no known prehistoric Native American sites within the limits of the Park. However, several areas are considered archeologically sensitive for prehistoric Native American sites. These areas tend to be along streams or drainages, near springs, and the area around The Pogue.<sup>4</sup> Additionally, identified historic archeological sites include above-ground features associated with the McKenzie Farmstead, Hilltop Farm, and sugarhouse.<sup>5</sup>

#### 4.1.4 ETHNOGRAPHIC RESOURCES

As defined by the National Park Service, an ethnographic resource is a site, structure, object, landscape, or natural resource feature assigned traditional, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it.<sup>6</sup>

The relationship between the Mount Tom Forest and the local community has been a vital part of the property's history. Local residents associate the property with Woodstock's long-established way of life as a retreat and tourist community. Use of the property for pedestrian and equestrian recreation and as an environment for learning about natural history and sustainable forest management are important aspects of the ethnographic character of the property.<sup>7</sup> The property is also an important visual component of the local landscape, both as a distinctive setting for the village of Woodstock and as a prominent feature in many views throughout the area (see Section 4.6.3 below). In addition, forestry activities on the property have contributed to the local economy since Billings' time.

With respect to Native American ethnography, traditional associations between the Abenaki and resources within or adjacent to the Park are not known.<sup>8</sup>



From top: Legacy tree in Stand #6 (OCLP 2004); apple trees in Stand #12 (MABI 1999); remnant sugaring artifacts (OCLP 2003).

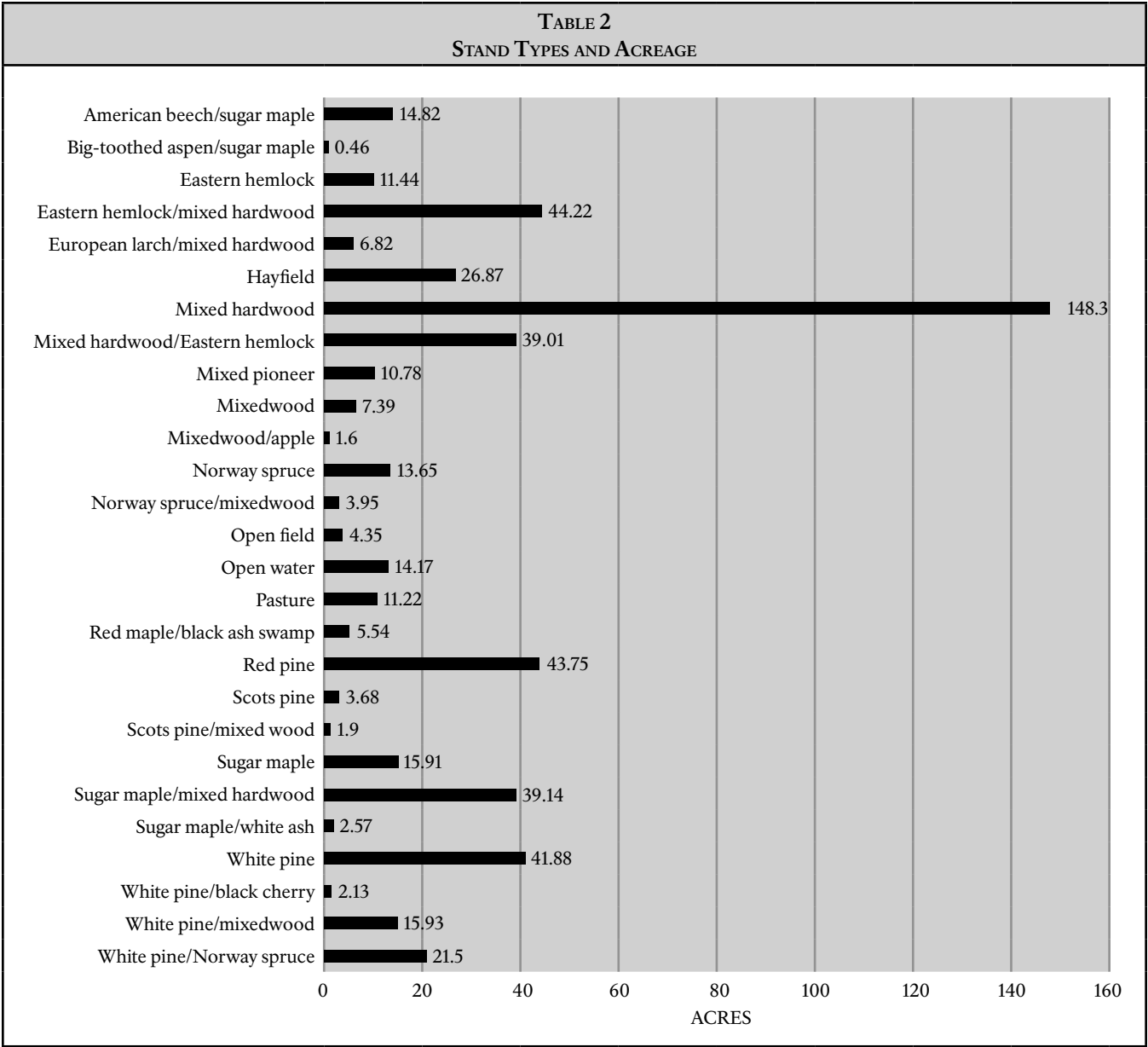
For locations of many of the cultural landscape features discussed above, see the fold out map “Cultural Landscape Features” at the end of this chapter.

## 4.2 NATURAL RESOURCES

### 4.2.1 VEGETATION

#### 4.2.1.1 Forest Stands

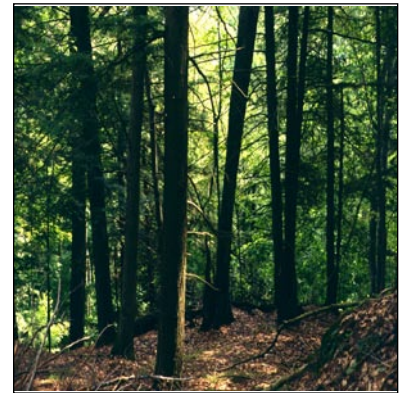
Forest stands are the basic organizational unit used to describe forest management at the Park. Forest stands are contiguous groups of trees sufficiently uniform in age-class distribution, composition, and structure, and growing on a site of sufficiently uniform quality, to be a distinguishable unit. The Mount Tom Forest



is divided into forty-seven forested stands (averaging 10.56 acres per stand) and several distinct pastures, hayfields, and meadows. Naturally regenerated forest stands dominate the Forest, comprising 63 percent of the forested land. The majority of these stands are mixed hardwoods (146 acres or 29 percent of the forested area), followed by plantations, which comprise 26 percent of the Forest. Table 2 lists all of the forest types on Mount Tom and the acreages they cover. For a detailed list of stands and their forest types, see Appendix D.

#### 4.2.1.2 Natural Communities

Natural communities are interacting assemblages of species and their environment (e.g., soils, slope, aspect, and climate). Although natural communities are typically defined as areas without significant disturbance by humans for the past seventy years or more, the Park's managed forest retains enough characteristics to assess the natural community classification of most existing stands and to estimate the potential natural communities that could develop in existing conifer plantations and fields.<sup>9</sup> The Park includes sixteen natural communities, with more than half of the natural forest stands classified as Northern Hardwood Forests. With limited management and intervention, the number of communities will likely be reduced and plantations will be succeeded by similar forests occurring on the adjacent natural stands.<sup>10</sup> Table 3 details the acreage and distribution of the park's natural communities. A map of these communities can be found at the end of this chapter.



Top, winter view of tree crowns (MABI 1999); bottom, hemlock forest along the Pogue stream (Tom Lautzenheiser 2002).

TABLE 3  
ACREAGE AND DISTRIBUTION OF NATURAL COMMUNITIES <sup>11</sup>

	Type of natural community	Acres	Percent	General location/Distribution
Terrestrial Habitat	Northern Hardwood Forest	57	10.3	Northern and western portions of the Park
	Sugar Maple-White Ash Forest	43	7.7	North Ridge, West Ridge
	Rich Northern Hardwood Forest	14	2.5	West Ridge
	Northern Hardwood Limestone Forest	9	1.6	West Ridge
	Hemlock Forest	55	9.9	Pogue Stream valley
	Hemlock- Northern Hardwood Forest	136	24.5	Eastern parts of the Park
	Dry Oak Forest	0.1	0	Mount Tom Ridge
	Hemlock-Oak Forest	6	1.1	Mid-slope of Mount Tom
	Temperate Calcareous Outcrop/Cliff	1	0.2	Eastern face of Mount Tom/ Southern end of West Ridge
	Native Conifer Plantations	112	20.2	Mansion grounds, Pogue Stream valley, west of West Ridge, near Elm Lot and French Lot overlook, north of Pogue, Prosper Road entrance
	Exotic Conifer Plantations	40	7.2	Mansion grounds, French Lot overlook, north of Pogue, McKenzie Farm, Prosper Road entrance
	Maintained Fields/Pasture	43	7.7	South and east of the Pogue
Aquatic/Wetland Habitat	See Section 4.2.3, Water Resources and Wetlands, below			



From top: Rich hardwood forest on the West Ridge (Tom Lautzenheizer 2002); SCA and VYCC volunteers removing invasive plants (MABI 2004).

#### 4.2.1.3 Natural Communities of Special Concern

There are several natural communities within the Park that have enhanced biological diversity or are sensitive to forestry practices as to warrant special management precautions. In addition to those areas discussed under Section 4.2.3 Water Resources and Wetlands, natural communities of special concern for forest management also include Rich Northern Hardwood Forest. These areas often host a great degree of species diversity and are characterized as containing sugar maple, white ash, blue cohosh, and maidenhair fern.<sup>12</sup> This natural community type is common in Vermont and considered resilient to selection harvests if patch cuts are kept small and precautions taken against invasive plants.<sup>13</sup> However, the largest area of this community type in the Park is located west of The Pogue and is largely unsuitable for forestry because of its extreme slope (35 to 60 percent), which creates severe erosion hazard and equipment limitations.<sup>14</sup>

#### 4.2.1.4 Native Plant Species of Special Concern

A 1997 study identified eleven plant species of special concern in the Park. Four of these species grow wild and seven grow exclusively in cultivated or semi-cultivated areas. Wild-growing plants included such species as Minnesota sedge, leathery grape fern, and broad beech fern. Leathery grape fern and broad beech fern were not located in the actual survey, but were included because they were reported to have been recently found in the area west of The Pogue.<sup>15</sup> Of the eleven rare plants found, only the male fern is a state-listed threatened species, and it grows under cultivated conditions. There are no federally listed threatened or endangered plant species known to occur within the Park.

#### 4.2.1.5 Invasive Exotic Plants

Over twenty exotic plants of concern have been inventoried in the Park, several of which are listed as Class I, highly invasive, by the Vermont Nongame and Natural Heritage Program. The species include: bush honeysuckle, Japanese honeysuckle, barberry, common buckthorn, glossy buckthorn, Norway maple, wild chervil, swallowwort, garlic mustard, and autumn olive.<sup>16</sup> Distribution of invasive plants coincides with areas of recent forest disturbances, field edges, and borders with adjacent residential lands.<sup>17</sup> Over the past two years, Park staff have treated populations of invasive plants of high priority with the assistance of the Student Conservation Association and the Vermont Youth Conservation Corps.

#### 4.2.1.6 Forest Stand Structure

The structure of the Park's forest stands varies widely, providing a diversity of wildlife habitats and other ecological functions.<sup>18</sup> Many forest stands are developing greater vertical diversity as intentional forest thinning and natural aging of the stands opens up the canopy, increasing light for shade-tolerant trees in the understory. Early monitoring and forest inventories suggest that forest management in the Park appears to have mimicked some natural disturbance processes in both plantations and hardwood and mixed forest stands, supporting



Conifer regeneration in red pine stand (Stand #26). (MABI 2005)

increased structural and species diversity within these stands. Some of the Park's oldest plantations are starting to develop late-successional structural characteristics.<sup>19</sup>

#### 4.2.1.7 Stocking, Growth, and Yield

Stocking, growth, and yield are important silvicultural terms that describe the productivity of the forest and provide fundamental measurements for sustainable forest management. If wood is harvested faster than it is grown, then forest management is considered unsustainable. While harvests in any individual year are likely to exceed the growth during that year, in a sustainably managed forest *average annual harvests* do not exceed *average annual growth and yield*.

A recent survey of forest diversity and tree volume indicates that the Park's forests are fully to over stocked, with stocking levels near, above, or well above the USDA Forest Service recommended residual stocking level, or "B" line, in all cases.<sup>20</sup> (See Appendix D for an overview of stocking levels for each stand.)

Forest stands within the Park show little or no reduced vigor due to age, although some of the oldest plantations are probably slowing their overall growth rate.<sup>21</sup> There are approximately 7,000,000 board feet of timber and 4,500 cords of pulpwood in the forested stands of the Park, most of which is found in the small and large sawtimber class sizes.<sup>22</sup> On average, total volume production is higher in hardwood and mixed forest stands, but board feet production is higher in plantations due to the greater number of larger-diameter trees with desirable growth forms in those stands.<sup>23</sup>

The USDA Forest Service estimates that the average annual growth of timberland in Vermont is approximately a third of a cord per acre.<sup>24</sup> Site-specific data gathered in sixteen reference stands within the Park and analyzed for a three-year period indicate that annual volume production is 1.47 cords per acre, well above the statewide average.<sup>25</sup> In the future, site index data will also be gathered as part of regularly scheduled forest inventories. These data will be used to generate stand-specific estimates of growth and provide more accurate determinations of yield and allowable cut.<sup>26</sup>

#### 4.2.1.8 Downed Coarse Woody Debris (CWD)

CWD is an important structural feature that influences wildlife habitat, nutrient cycling, tree regeneration, below-ground communities, and other ecological functions associated with forest ecosystem health.<sup>27</sup> In streams, CWD also provides important aquatic habitat and nutrient regulation.<sup>28</sup> CWD volumes vary substantially throughout the Park; however, overall CWD volumes are less than half the mean values recorded for moderate to highly productive mature northern hardwood forests throughout the region.<sup>29</sup>



Top, crowded red pine stand with stocking well above the B-line; bottom, growth rings of red pine cross-section showing decrease in growth rate. (MABI 2004)



Downed coarse woody debris in wetland east of The Pogue. (MABI 2001)



Top, thriving and dead legacy trees in Stand #6; bottom, dead legacy tree in Stand #8. (OCLP 2004)

#### 4.2.1.9 Snags

The Park's forests contain snags (i.e., standing dead wood) with a full range of decay stages. However, decay class distributions vary considerably among stands. Snags in several stands consist mostly of less-decayed material, resulting from recent tree mortality. Other stands are weighted toward more moderate or well-decayed material, while several stands have fairly even distributions of snags among decay classes. Spatial variability across the Park limits population sizes of territorial snag-associated wildlife, such as most woodpecker species.

#### 4.2.1.10 Legacy Trees

The land use history of the Park has resulted in the retention of numerous remnant open-grown pasture trees and hemlock over 300 to 400 years old. As discussed in Section 2.2.3, these "legacy trees" biologically enrich the Park's forested ecosystems. They provide an abundance of habitat values including cavities utilized by a host of species and enhance vertical structure of forest stands.<sup>30</sup> Diameter distributions of the legacy trees in the Park extend well beyond the sizes reported for natural hardwood and old-growth northern hardwood–hemlock forests in the Northeast. Most legacy trees appear to be vigorous and healthy despite their age, providing opportunities for continued retention.<sup>31</sup>

Dying legacy trees can also enhance forest health and wildlife use. Large snag structures are ecologically important for a wide array of species.<sup>32</sup> As these trees continue to decay and fall, they become an important source of downed coarse woody debris of exceptional size.

### 4.2.2 TOPOGRAPHY, SOILS, AND GEOLOGY

The topographical elevations in the Park range from about 700 to 1,450 feet above sea level, with the ridge west of The Pogue being highest point.

The entire Park lies on Silurian-Devonian bedrock, mainly the Waits River Formation (a limestone/marble complex), and a small portion is underlain by Standing Pond Volcanics. The Shelburne Drift covered the area, and an ice dam near what is now the village of Woodstock created a large high-level lake that extended up the valley of the Ottauquechee River. Most of the Park is described as glacial till, with limited exposed bedrock.<sup>33</sup>



Rock cut on the North Ridge Road. (OCLP 2003)

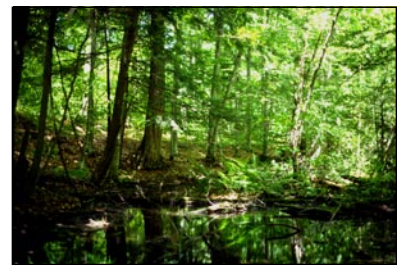
Primary soil units found within the Forest include Dummerston, Pomfret, Glover, and Vershire. Roughly two-thirds of the Forest is composed of state-designated prime forest soils, including areas to the east and south of The Pogue and to the west, along Prosper Road. The Forest also contains pockets of state-designated prime agricultural soils, which are found to the south of The Pogue and to the west of the Mansion Grounds.<sup>34</sup>

### 4.2.3 WATER RESOURCES AND WETLANDS

The Pogue, a 14-acre pond created by an earthen dam, is located in the center of the Park surrounded by hardwood forests and an 1896 mixed conifer plantation. The Pogue receives its water from rainfall, submerged springs, and two intermittent streams that flow off the ridge to the west of The Pogue. Two sets of irrigation pipes draw water from The Pogue. One supplies two watering troughs along the main carriage road; the other provides irrigation water to the Mansion Grounds and the Billings Farm & Museum.

A perennial stream, the Pogue Stream, drains The Pogue and most of the Park into Barnard Brook, which feeds into the Ottawaquechee River. Before leaving the Park, the Pogue Stream runs through hemlock-hardwood forests and a pasture, which was recently re-fenced to exclude animals from the stream channel. Results from a Level I Water Quality Inventory indicate that the overall surface water quality of The Pogue and Pogue Stream is “good,” and that there are no serious sources of water pollution in the Park.<sup>35</sup>

Several wetlands and seeps are located throughout the Park. The most extensive concentration is located north and east of The Pogue where a complex of three wetlands is linked by intermittent streams. The underlying bedrock in this area is calcareous; and as a result, the pH of this seep-wetland complex is relatively high.<sup>36</sup> An inventory of vernal pools, which located ten pools in or adjacent to the Park, identified this complex as one of the prime areas in the Park for breeding populations of vernal pool species.<sup>37</sup> No National Wetland Inventory designated wetlands are found in the Park.<sup>38</sup> Acreage and distribution of the park’s aquatic and wetland natural communities is listed in Table 4 below. A map of wetlands, vernal pools, and seeps can be found at the end of the chapter.



Top, the Pogue Brook (MABI 2002);  
bottom, vernal pool near The Pogue  
(Tom Lautzenheizer 2002).

TABLE 4  
ACREAGE AND DISTRIBUTION OF AQUATIC AND WETLAND NATURAL COMMUNITIES<sup>39</sup>

Type of natural community	Acres	Percent	General location/Distribution
The Pogue	14	2.5	Center of the Park
Red Maple-Black Ash Swamp	14	2.5	East of Pogue and near Prosper Road entrance
Hemlock Swamp	3	0.5	West of North Ridge
Seeps and Vernal Pools	n/a	n/a	Scattered

### 4.2.4 WILDLIFE

#### 4.2.4.1 Amphibians and Reptiles

As of 2000, thirteen amphibian species (six salamanders, seven frogs) and five reptiles (three snakes, two turtles) were documented in the Park. Of these, eleven amphibian species (six salamanders, five frogs) and two reptile species were confirmed to have breeding populations in the Park, though all the reptiles are



From top: Jefferson salamander (MABI 2000); painted turtle (MABI 2001); raccoon prints (MABI 2002).

suspected to breed within the Park area. Significant breeding populations of the Jefferson salamander were documented at the Park, centered around the vernal pools north and east of The Pogue. The Jefferson salamander is considered a “Species of Special Concern” by the Vermont Fish and Wildlife Department Nongame and Natural Heritage Program. In addition, the Northeast Endangered Species Technical Committee recently listed the Jefferson salamander as a species of regional conservation concern.<sup>40</sup>

#### 4.2.4.2 Birds

Ninety-one bird species were detected during a two-year breeding bird inventory project conducted in the Park. Of these, seventy-three species were confirmed or suspected to be breeding within the Park or on adjacent lands, fifteen species were considered local breeders that may nest occasionally or in the future on Park lands, and three species were strictly transients. No threatened or endangered species were noted during breeding bird surveys. Cooper’s hawk, listed as “special concern” by the Vermont Agency of Natural Resources, was observed during surveys, but nesting was not confirmed. Twenty-three species are listed on either the Partners in Flight priority list for the northern New England region or on the Vermont list of rare and uncommon birds. Fourteen of these are forest bird species that are considered conservation priorities. All but three of these species prefer forested areas with sapling-sized or larger trees.<sup>41</sup> Fields contained relatively few species compared to the Park’s forested areas. One field species (bobolink) was found nesting in small numbers (about five pairs) in the hayfields.

#### 4.2.4.3 Bats

A bat biodiversity study documented seven species through mist-netting and acoustic monitoring. Neither the federally endangered Indiana myotis nor the state-threatened eastern small-footed myotis were detected during the survey. Trapping data suggest that The Pogue is the primary foraging area, which the bats access by using carriage roads as travel corridors.<sup>42</sup>

#### 4.2.4.4 Large Mammals (Deer, Moose, and Bear)

Deer wintering areas are located along the northern slopes of Mount Tom and the western end of the Park along the slopes above Prosper Road.<sup>43</sup> A forest dynamics monitoring study indicates that browsing by deer is having an effect on forest successional dynamics, with a significantly larger effect in conifer stands (e.g., plantations and hemlock stands) than in mixed woods and hardwood stands.<sup>44</sup> Moose and bear are known to travel through the Park on occasion, but limited information is available to assess the regularity and extent of their use of the Forest.

#### 4.2.4.5 Small Mammals

Field work for a small mammal inventory has been completed and a final report is expected by the end of 2005.

#### **4.2.4.6 Fish**

Two species of fish, largemouth bass and yellow perch, were documented in The Pogue. Only yellow perch is native to this area. However, because The Pogue was formerly an upland bog, both of these species were likely introduced.<sup>45</sup> Park streams are intermittent, and therefore do not contain fish.

#### **4.2.4.7 Wildlife and Forest Patch Composition**

As discussed previously in Section 2.2, the Forest provides diverse wildlife habitats, such as hiding/resting cover, nesting sites, and foraging habitats, which are associated with differences in forest stand density and composition.<sup>46</sup> The juxtaposition of diverse patches over relatively small spatial scales represents a high-quality habitat configuration for many wildlife species, especially generalists and those requiring multiple habitat types. This pattern may reduce habitat quality for some species, however, such as those associated with the interiors of specific patch types.<sup>47</sup>

### **4.2.5 REGIONAL CLIMATE**

Woodstock receives approximately 40 inches of precipitation annually, evenly distributed throughout the year. The frost-free period generally lasts from late May to mid-September. One-quarter of the annual precipitation comes in the form of 90 inches of snow, which is usually on the ground from mid-December to April. Summer temperatures average 70 degrees Fahrenheit, with highs reaching the 90s. In winter, subzero temperatures are common.<sup>48</sup>

### **4.2.6 NATURAL DISTURBANCES**

#### **4.2.6.1 Pests and Pathogens**

Native and non-native pests and pathogens impact Northeastern forests differently, and require diverse management approaches. Since the mid-1800s, the composition and structure of New England forests have been drastically altered by the arrival of numerous non-native insects and diseases including the chestnut blight (1904), white pine blister rust (1914), gypsy moth (1869), and Dutch elm disease (1950–60). The recent establishment of insects such as the Asian long-horned beetle and emerald ash borer within the United States has brought additional attention to the risk posed to forests by non-native pests. In addition to Asian long horned beetle and emerald ash borer, other organisms that are potential risks to the Mount Tom Forest include hemlock woolly adelgid, butternut canker, and beech bark disease. Because these organisms have not evolved as components of local ecosystems, native trees are not resistant to these pests and often there are few or no predators or competitors that counter the rapid growth of their population. This often results in widespread and severe impacts to trees and the associated ecological systems.

Levels of native pests and pathogens infection or infestation are more indicative of tree and forest health. These organisms have evolved within local ecosystems; therefore, host tree species have developed protection strategies and the ecosystem includes active predators and competitors that control populations of these organisms. Some examples of native pests and pathogens that exist at the Park include *Armillaria mellea*, *Phellinus pini*, and *Glycobius speciosus*.



Close up of beech bark nectria. (MABI 1999)

The Park is currently monitoring the effects of insects and diseases on forest health through the long-term forest dynamic monitoring program and annual site surveys from professional foresters. Site-specific data indicate significant levels of defoliation, decline, or physiological stress for six tree species in the Park: beech, butternut, green ash, white ash, red maple, and American basswood.<sup>49</sup> Beech bark disease is the most widespread of the insects and diseases affecting these species. Infection levels suggest that portions of the Park are within a regional “killing front” of heavy beech bark disease-related mortality. Over time, as mortality takes its toll, infection rates may recede into an “aftermath” stage, in which only a few residual, resident large beech survive. During this phase, many saplings may sprout from the roots of the dying and dead trees; these may co-exist with the few large remaining resistant overstory trees to form a two-aged beech forest.<sup>50</sup>

The Park is also developing a forest health monitoring program and Integrated Pest Management (IPM) Plan to refine data on native and non-native forest pests and develop management strategies that will draw upon the principles and best practices of IPM. In conjunction with these efforts, the Park recently completed a risk analysis for hemlock woolly adelgid, a non-native pest that has devastated hemlock forests in other areas of the Northeast.<sup>51</sup>

#### 4.2.6.2 Fire

Historically, fire was not frequent or widespread for most areas in New England. Moist, rolling uplands are particularly fire resistant, averaging burns at intervals greater than 1,000 years. Fires that do occur tend to be along dry ridgelines.<sup>52</sup> The species composition in the Park is representative of Historic Natural Fire Regime V, which is characterized by a long interval between fires and stand replacement of over 200 years. Other area environmental historians estimate that frequency of fires in northern hardwoods averages of 800 to 1,400 years.<sup>53</sup> The majority of recent wildland fires that have occurred in Vermont have been less than an acre in size, and only 2 percent of these fires were the result of natural ignition sources (i.e., lightning).<sup>54</sup> Two wildland fires were reported to have occurred on Mount Tom, one during the beginning of the nineteenth century and the second in 1845. Both were caused by human activity.<sup>55</sup>

#### 4.2.6.3 Wind Events

Historical trends of wind events in New England suggest that storms resulting in light damage (i.e., branches broken, trees damaged) are likely to occur every

ten to fifteen years. Storms of moderate intensity (i.e., trees blown down) are estimated to occur at intervals approximating 25 to 65 years. The most severe events, resulting in extensive blow-downs, occur at increments greater than 380 years.<sup>56</sup> Major hurricanes were reported to have caused widespread forest loss in 1821 and 1938.<sup>57</sup> Studies of experimental forests in the region report that nearly 80 percent of wind events result in areas of damage that are less than a hectare in size.<sup>58</sup> As stands age and increase in relative height, they are more prone to damage from wind events; and conifers, particularly white pine trees, are especially subject to blow-downs.<sup>59</sup> Most of the wind events in New England move in a southeast-to-northwestern pattern, making southern-exposed ridges particularly prone to storm damage. The white pine plantation on the south-facing slope of the ridge west of The Pogue appears to be prone to blowdown events, as evidenced in historic aerial photographs and recent activities.

#### 4.2.7 AIR QUALITY

##### 4.2.7.1 Ozone

Ozone monitoring data is available from a station in Sullivan County, New Hampshire, 35 miles from the Park. The Park is one of only four National Park Service units in the Northeast Temperate Network where ozone levels do not exceed EPA's human health-based eight-hour National Ambient Air Quality Standard (NAAQS). High levels of ozone can damage the foliage of vegetation, reducing tree vigor and vitality. Based on 1995–1999 seasonal average ozone levels, it is uncertain if ozone injury would occur at the Park. Ozone-sensitive plant species at the Park were identified by the NPS Northeast Temperate Inventory and Monitoring Program; and the Vermont Agency of Natural Resources has begun to monitor some of these plants at the Park.<sup>60</sup> However, site-specific data on foliar damage from ozone are not available at this time.

##### 4.2.7.2 Visibility

The closest monitoring sites for air quality are Lye Brook Wilderness Area, Vermont (site #LYBR1), Great Gulf Wilderness Area, New Hampshire (site #GRGU1), and Quabbin Reservoir, Massachusetts (site #QURE1). To this date, not enough data have been collected and analyzed from these sites to assess trends in visibility.<sup>61</sup>

##### 4.2.7.3 Dry Deposition

Dry deposition for the area is measured at Hubbard Brook, New Hampshire (from 1989 to present), and Lye Brook, Vermont (from 1994 to present). Both the Hubbard Brook and Lye Brook data showed no trend in nitrogen deposition levels. Sulfur deposition increased at Lye Brook, but no trends were observed at Hubbard Brook.<sup>62</sup>



Damage from 2003 windstorm. (MABI 2003)

#### 4.2.7.4 Wet Deposition

Wet deposition for the area is measured at Hubbard Brook, New Hampshire (since 1978) and Bennington, Vermont (since 1981). Both stations show a decrease in concentration and bulk deposition of sulfate, a slight decrease in concentration and deposition of nitrate, and no overall trend in concentration and deposition of ammonium.<sup>63</sup>



### 4.3 SUSTAINABLE MANAGEMENT PRACTICES

#### 4.3.1 A TRADITION OF MANAGEMENT

Mount Tom is a place where the interaction of people and nature has played out on the landscape for nearly 200 years. Agricultural activities have included maple sugaring, haying, grazing, orchard management, mushroom growing, and gardening. Today, mature sugar maples line sections of the carriage roads and are found in many of the forest stands. Remnants of a sugar house are evident near the Woodbarn, and a remnant orchard can be found near the McKenzie Farmstead. Hay continues to be cut from the open fields.



As discussed in previous sections, sustainable forest management on Mount Tom began with Frederick Billings in the 1870s; and from that time forward, the Forest has been continuously managed using the philosophy and techniques of best forest management of the day. Historically, forest management activities included tree planting, forest thinning and pruning, and harvesting. Wood was drawn by horses, and later tractors, to the Woodbarn where it was sawn and dried. The Forest was designated as Vermont's first Tree Farm in 1953, and is today recognized as a demonstration Tree Farm in the American Tree Farm System and certified by the Forest Stewardship Council (FSC).



#### 4.3.2 MODELING SUSTAINABLE MANAGEMENT PRACTICES

The Park has initiated several projects to continue the tradition of sustainable forest management on Mount Tom. Recent examples of sustainable management activities include:

- **Third-Party Certification Pilot Project.** As part of a pilot project funded through the Pinchot Institute for Conservation, the Park participated in a voluntary assessment under the Forest Stewardship Council certification system to demonstrate and interpret certification as a new chapter in the Park's legacy of conservation stewardship. Third-party certification is one of the fastest-growing new developments in sustainable forestry. The purpose of certification programs is to provide market recognition of good forest management through credible, independent verification of sustainable forest practices.

From top: Spruce plantation on the Billings Estate, photographed in 1902 by a photographer for the Arnold Arboretum (Arnold Arboretum); hauling logs at the Woodshed by tractor in winter c.1960 (Billings Farm & Museum Library and Archives, courtesy of the Corkum Family); Tree Farm sign on main carriage road (MABI 2000).

- **Value-Added Products.** As described in Section 3.3.3, value can be added to products through their association with a place, sustainable management, and craftsmanship. To interpret these important connections, the Park is working with Eastern National, the Park's cooperating association, to commission products made from wood harvested on site. Locally crafted items such as bowls and pens are sold at the Park's visitor center bookstore. Wood from Mount Tom has also been used visitor center furniture, rehabilitating historic buildings, and Park maintenance projects.
- **Integrated Pest Management.** In accordance with NPS Management Policies, the Park is developing and implementing an integrated pest management (IPM) program to reduce risks to the public, Park resources, and the environment from pests and pest-related management strategies.<sup>64</sup> IPM is a decision-making process that coordinates knowledge of pest biology, the environment, and available technology to prevent unacceptable levels of pest damage by cost-effective means, while posing the least possible risk to people, resources, and the environment. Chemical and biological controls are only used when other available options are either not acceptable or not feasible. Additionally, all pesticide treatments (as defined by the Federal Insecticide, Fungicide and Rodenticide Act) are reviewed by the NPS Northeast Region IPM Coordinator, and all pesticide use at the Park is reported annually.
- **Crop Tree Release Demonstration Site.** A demonstration site was created to exhibit crop tree management techniques for enhancing the growth of selected forest trees, and improving wildlife habitat, recreational opportunities, and forest aesthetics. The demonstration site was developed through a public workshop held in cooperation with the USDA Forest Service and Vermont Department of Forests, Parks, and Recreation. The growth of the crop trees is annually measured to evaluate the effectiveness of the treatment.
- **Carriage Road Rehabilitation.** Annual work on the carriage roads maintains and enhances ditches, water bars, culverts, and retaining walls to stabilize the roads, prevent erosion, and maintain good drainage.



**Top: Visitor center furniture made from wood from Mount Tom; bottom, local craftsmen discuss the art of their trade with visitors during the installation of the visitor center furniture (MABI 2000).**

## 4.4 EDUCATION AND INTERPRETATION

### 4.4.1 A TRADITION OF LEARNING FROM MOUNT TOM

From Marsh's time forward, Mount Tom has been a place of exploration, demonstration, and contemplation. As a boy, Marsh explored the slopes of Mount Tom, learning about ecological concepts such as watersheds and identifying local flora. When Frederick Billings began his ambitious forestry program, he invited the public to explore the estate and examine his reforestation techniques in hopes of informing and inspiring them to practice similar stewardship efforts on their lands. The Billings women—Frederick's wife Julia and daughters Laura, Elizabeth, and Mary Montagu—continued in his tradition, drawing upon and demonstrating best forest management practices and encouraging the public to explore the

"I sat on a little stool between my father's knees in the two-wheeled chaise he always drove. To my mind the whole earth spread out before me. My father pointed out the most striking trees as we passed them and told me how to distinguish their varieties. I do not think I ever afterward failed to know one forest tree from another... What struck me, perhaps most of all, he stopped his horse on top of a steep hill, bade me notice how the water there flowed in different directions, and told me such a point was called a watershed. I never forgot the word, or any part of my father's talk that day."

*Caroline Crane Marsh's Life and Letters of George Perkins Marsh*

Forest. Elizabeth Billings was also a skilled naturalist. She established several gardens of ferns, mushrooms, trees, and herbaceous plants that were a sampling of local biodiversity and a study of non-native flora. Elizabeth also commissioned a biological inventory of all plants within a 6-mile radius of Woodstock. Together, she and botanist Elsie Kittredge studied and collected samples of nearly 1,500 plant species that inhabited Mount Tom and the surrounding area. Mary and Laurance S. Rockefeller continued the tradition of encouraging the public to explore and learn about the Forest. During the Rockefeller tenure, demonstrations of best forestry practices continued, including the Forest's enrollment as Vermont's first Tree Farm in 1953 and conducting a demonstration project with the Vermont Agency of Natural Resources on cabling skidding in the 1980s. The Rockefeller's consulting forester, John Wiggin, also established a native wildflower garden and interpretive brochure for local residents and visitors to learn about local biodiversity.

#### 4.4.2 THE MOUNT TOM FOREST AS A LEARNING LABORATORY TODAY



From top: Participants with Biltmore sticks during Forest for Every Classroom (MABI 2001); baskets on display during the Forest Festival Weekend (MABI 2002); ranger-led hike passing the French Lot (MABI 1999).

The Park seeks to continue the tradition of education on Mount Tom and to strengthen the human commitment to stewardship by engaging in educational initiatives and resource management activities that tell the evolving story of conservation; demonstrate sustainable forest management; and encourage reflection, dialogue, and lifelong learning.<sup>65</sup> To accomplish this, the Park has developed a number of place-based education and interpretive programs to connect the Forest to the personal lives of its many audiences. Example programs include:

- ***A Forest for Every Classroom (FFEC).*** FFEC is a professional-development program for educators focused on place-based education. Teachers who participate in FFEC develop curricula that foster student understanding and appreciation of their communities' public lands and forest resources. The teacher-developed curricula integrate hands-on natural and cultural explorations that address concepts in ecology, sense of place, stewardship, and civics. At the heart of the FFEC program is the belief that students who are immersed in the interdisciplinary study of their own "place" are more eager to learn and be involved in the stewardship of their communities and public lands. Many of the teachers study the Mount Tom Forest as part of the training, and then bring their students for field visits as part of the curriculum that they create.
- ***Forest Festival Weekend.*** This is an annual event that includes two full days of workshops, walks, and demonstrations that explore the multi-faceted nature of the Forest. Presentations have included: reading the landscape using clues from the past; natural history of wood; woodcraft demonstrations; drawing and dendrology for children; and a walk with the County Forester.
- ***The Paths Less Traveled.*** Every season from May to October, the Park offers a series of ranger-led hikes on topics that range from land use change, the history of forest management, wildflower and invasive plant

identification, environmental values, conservation and art, to the writings of George Perkins Marsh.

- **Working Woodlands.** In cooperation with the USDA Forest Service State and Private Forestry, the Vermont Agency of Natural Resources, and other organizations, the Park offers a series of education workshops on sustainable forest management practices for landowners and professionals.

## 4.5 VISITOR USE AND RECREATION

### 4.5.1 A TRADITION OF RECREATIONAL ENJOYMENT

Recreation has always been an important aspect of the property's history. Frederick Billings designed the carriage road system to accommodate day-to-day forest management activities and serve as a scenic drive for himself and the community. The carriage roads also filled an even more important stewardship objective for Billings. With them, Billings encouraged the public to explore his estate and learn about practices in scientific forestry and farming that could be used to improve their own lands, restoring their appearance, environmental stability, and profitability.

Since the 1870s, the roads and trails of Mount Tom have been open for the public to enjoy walking, horseback riding, and carriage drives. During the 1970s, the trail network was expanded and groomed during the winter by the Woodstock Resort Corporation for cross-country skiing and snowshoeing.

### 4.5.2 PROVIDING DIVERSE RECREATIONAL EXPERIENCES

The Park's carriage roads and trails are open to free public access from dawn to dusk. During winter months, the carriage roads and many of the trails are part of a wider network of cross-country skiing trails, operated under easement by the Woodstock Resort Corporation and open to the public for a fee.

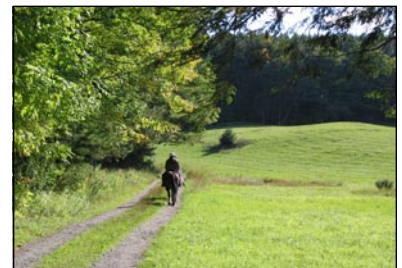
Since the Park's opening in 1998, visitation to the Park has increased from approximately 18,000 to almost 50,000 visitors a year.<sup>66</sup> According to the Woodstock Chamber of Commerce, an estimated 400,000 to 500,000 people visit the town each year. Visitors to Woodstock are typically interested in places of historical or cultural value and opportunities for outdoor recreation. When the property passed to the National Park Service in 1992, recreational activities permissible under the conditions of the deed were identified. These include cross-country skiing, snowshoeing, hiking, horseback riding, and associated activities such as nature/wildlife observation. In accordance with the deed, motorized vehicles (except for Park use), hunting, biking, fishing, swimming, camping, and campfires are prohibited.



Invasive plants workshop offered as part of the Working Woodlands series. (MABI 2005)



Nellie Warren Kidder, a Billings family friend, driving on the Mount Tom carriage roads, c.1887-96. (Album 26, Billings Family Archives)



Top, hikers on the main carriage road (OCLP 2003); bottom, equestrian on the South Peak Road (MABI 2003).

## 4.6 WATERSHED AND COMMUNITY CONNECTIONS

### 4.6.1 RECREATIONAL CONNECTIONS



From top: View east of Woodstock from Mount Tom (MABI 2003); view south from the West Ridge (OCLP 2003).

“Mr. Billings’ drive to the summit of Mt. Tom is nearly completed, and is a surprise to everybody by reason of its easy grade. From the point where it leaves the “Pogue Hole” road, in the field a little way above the woods, to the summit a team may trot every rod, and a portion of the way one passing over it seems almost suspended in air. The outlook is grand. The road is so broad that teams may pass each other at any point and it is to be graveled and made first-class. Only think what an attraction this is to be to Woodstock! Though a private enterprise, the public are permitted to enjoy it freely.”

*Vermont Standard,*  
September 1, 1887

One of the main carriage roads and several historic footpaths connect the National Historical Park lands to the summits of Mount Tom located in the Billings Park, a town-owned forest. Billings Park, once part of the original Billings Estate, was gifted to the town of Woodstock by Mary Montagu Billings French in the 1950s.

These and other Park roads and trails are part of a community-wide system of trails and sidewalks that extend to the south and connect to Woodstock village and Mount Peg. On the Park’s eastern border, a recreational path is planned to connect village sidewalks and to areas north of town, such as the Mount Tom Farmers Market and Spectrum Teen Center.

### 4.6.2 ECOLOGICAL CONNECTIONS

Located in the Vermont Piedmont, the Mount Tom Forest is within the Ottauquechee River Watershed, a major tributary of the Connecticut River. Most of the surface water in the Forest collects in the Pogue Stream, flowing east into Barnard Brook, then south into the Ottauquechee. Water flowing from the southern slopes of Mount Tom descends by small streams through the Billings Park and directly into the Ottauquechee. Large areas of contiguous forest lie to the west of the Park. The area has been identified as significant wildlife habitat by the Chateaugay No Town Conservation Project (a public-private partnership focused on the conservation of over 60,000 acres in the towns of Barnard, Bridgewater, Killington, and Stockbridge) and as important bear habitat for southern Vermont by the Vermont Department of Fish and Wildlife.

### 4.6.3 SCENIC CONNECTIONS

The Park is a unique visual resource for the Woodstock area from a number of different vantage points. Viewed from the surrounding roads and overlooks from other public lands, the distinct patchwork of plantations and hardwoods offers a marked contrast from the surrounding hardwood and mixed forests, especially during the height of fall foliage color. Within the Park, the carriage road system and associated vistas offer a diversity of views to the surrounding forests and fields and the village of Woodstock.

### 4.6.4 ADJACENT LANDS

The Park lies between Route 12 to the north and Route 4 to the south. Between the Park and these major roads is a mix of public lands, private forest, agricultural

fields, and residential areas. The Park's western border is defined by Prosper Road, a town dirt road. The King Farm, owned by the Vermont Land Trust, abuts the Park along the southwestern border and includes a working farm and forest on its protected lands. The Billings Park, as mentioned in Section 4.6.1 above, abuts the Park along the southeastern border.

## 4.7 ADAPTIVE MANAGEMENT

Adaptive management is an approach to Park stewardship that bridges the gaps between management objectives and actions, unanticipated changes in the environment or organizational operations, and the development of new knowledge and best management practices. At its basic level, adaptive management is a process for the continual improvement of Park management based on monitoring and evaluation. Therefore, an important part of adaptive management is an inventory and monitoring program that identifies changes in Park resource conditions.

The first step in adaptive management is to develop a strong set of baseline inventories. Several baseline inventories have been conducted for the Park, including cultural resources (i.e., land use history, cultural landscape reports), natural resources (including birds, reptiles and amphibians, bats, natural communities, silvicultural conditions, invasive plants, and water quality), and visitor use surveys. Together, these studies provide the foundation for developing an effective adaptive management program for the Park.

The NPS Northeast Temperate Network Inventory and Monitoring Program (NETN), an initiative of the NPS Natural Resource Challenge, was created to design and implement ecological monitoring programs in eleven parks throughout the Northeast. The NETN is currently developing monitoring protocols for vital signs related to forest health, water quality, climate, etc. (see Appendix B). The Park will continue to work with NETN to integrate network-wide vital signs into the Park adaptive management framework.

Anticipating the importance of monitoring for forest management, the Park also established a long-term forest dynamic monitoring program in cooperation with the University of Vermont's School of Natural Resources. The program established sixty-four permanent plots throughout the Forest to assess successional dynamics and structural changes associated with forest stand development. The program measures a wide range of indicators, including: size class distribution and dominance, mortality processes and self-thinning, compositional dynamics and regeneration demography, deer browse impacts, crown condition, forest diseases, regeneration trends, vertical structure, downed coarse woody debris, dead tree structure, understory plant assemblages, and legacy trees.<sup>67</sup> Three years of baseline data have been collected through this



From top: collecting mammal inventory data (MABI 2004); fisher tracks from NETN mammal inventory (MABI 2004); UVM field team establishing long-term forest monitoring plot (Keeton 2004).

program thus far, and the results already have been valuable in informing forest management planning. The Park will work with cooperators to reassess these plots approximately every five years to continue to chart changes in forest development.

In addition to the long-term forest dynamic monitoring program, the Park is developing a program to reassess stand inventories and forest health in each stand at intervals of approximately every five years. This program will monitor the presence and impacts of native and non-native pests and pathogens, and assess standard silvicultural metrics including stocking levels, basal area, trees/acre, regeneration, coarse woody debris, and other parameters on a stand-by-stand basis.

## ENDNOTES TO PART 4

<sup>1</sup> The Forest's significance and integrity was assessed in a Cultural Landscape Report for the Forest, Site History (Wilkes et al. 2000) and Analysis (OCLP 2005 draft); Cultural Landscape Inventory (OCLP 2005 draft); Cultural Landscape Report for the Mansion Grounds (Auwaerter and Curry 2005 draft); historic context study on Billings' involvement in forestry (Nadenicek 2003 draft).

<sup>2</sup> The Rockefellers did, however, continue the tradition of establishing new plantations on abandoned agricultural lands that were part of other properties they owned in the area.

<sup>3</sup> NPS 1998.

<sup>4</sup> University of Vermont Consulting Archeology Program (UVM CAP) 2005 Draft.

<sup>5</sup> UVM CAP 2005 draft.

<sup>6</sup> NPS 1998, 181.

<sup>7</sup> As outlined in the Park's GMP and established in the deed that conveyed the property to the NPS, some long-standing uses of the property by local residents [e.g., hunting, fishing, camping, campfires, mountain biking, and swimming] are prohibited.

<sup>8</sup> NPS 1999, 51.

<sup>9</sup> Lautzenheiser 2002.

<sup>10</sup> Lautzenheiser 2002.

<sup>11</sup> Lautzenheiser 2002.

<sup>12</sup> Thompson and Sorenson 2000; Lautzenheiser 2002.

<sup>13</sup> Thompson and Sorenson 2000.

<sup>14</sup> NRCS 2004.

<sup>15</sup> Hughes and Cass 1997.

<sup>16</sup> Hughes and Cass 1997; USDA Forest Service 2004; NPS 2005 draft.

<sup>17</sup> NPS 2005 draft.

<sup>18</sup> Keeton 2005.

<sup>19</sup> Keeton 2005.

<sup>20</sup> USDA Forest Service 2004. The B-line is defined as the suggested residual stocking following a thinning, and it varies depending on the stocking chart for the species or species group being considered (e.g., larch, northern hardwood). Stocking charts are developed by the USDA Forest Service for silvicultural applications.

<sup>21</sup> Keeton 2005.

<sup>22</sup> USDA Forest Service 2004.

<sup>23</sup> Keeton 2005.

<sup>24</sup> Average annual net growth is defined as the new growth minus mortality and trees that become classified as culls over year-long period; it is normally expressed in terms of volume (e.g., board feet, cords, or cubic meters). USDA Forest Service 2005.

<sup>25</sup> Keeton 2005.

- <sup>26</sup> Yield is forest mensuration estimate of the amount of wood that may be harvested from a particular type of forest stand by species, site, stocking, and management regime at various ages; allowable cut is the amount of wood that may be harvested during a given period in a sustained yield forest management approach (Helms 1998).
- <sup>27</sup> Keeton 2005; Hunter 1999; Franklin et al. 2002.
- <sup>28</sup> Evans et al. 1993.
- <sup>29</sup> Keeton 2005.
- <sup>30</sup> Hunter 1999; DeGraaff and Yamasaki, 2001; Franklin et al. 2002.
- <sup>31</sup> Keeton 2005.
- <sup>32</sup> Hunter 1999.
- <sup>33</sup> Van Diver 1987; Doll 1969.
- <sup>34</sup> NPS 1999; Hydric soils are described in the Windsor County Soils Data (NRCS 2004).
- <sup>35</sup> Ferris and Chapman 2000.
- <sup>36</sup> Lautzenheiser 2002, NPS 1999.
- <sup>37</sup> Faccio 2001.
- <sup>38</sup> VCGI 2005.
- <sup>39</sup> Lautzenheiser 2002.
- <sup>40</sup> Therres 1995.
- <sup>41</sup> Faccio 2003; Vermont Department of Fish and Wildlife 2000.
- <sup>42</sup> Reynolds and McFarland 2001.
- <sup>43</sup> Vermont Department of Fish and Wildlife 1997.
- <sup>44</sup> Keeton 2005.
- <sup>45</sup> Mather et al. 2005.
- <sup>46</sup> Keeton 2005.
- <sup>47</sup> Keeton 2005; Curtins 1997; Franklin et al. 1997.
- <sup>48</sup> NPS 1999; Vermont State Climate Office-ARSCO (<http://www.uvm.edu/~ldupigny/sc>).
- <sup>49</sup> Keeton 2005.
- <sup>50</sup> Keeton 2005; Gavin and Peart 1993.
- <sup>51</sup> Machin et al. 2005.
- <sup>52</sup> Foster and Aber 2004; Thompson and Sorenson 2000.
- <sup>53</sup> Aber 2000.
- <sup>54</sup> Everson et al. 1993.
- <sup>55</sup> Dana 1889.
- <sup>56</sup> Boose et al. 2001.
- <sup>57</sup> Boose et al. 2001.
- <sup>58</sup> Foster and Aber 2004.
- <sup>59</sup> Foster and Aber 2004.
- <sup>60</sup> Shriver et al. 2004.
- <sup>61</sup> Shriver et al. 2004.
- <sup>62</sup> Shriver et al. 2004.
- <sup>63</sup> Shriver et al. 2004.
- <sup>64</sup> NPS 2001.
- <sup>65</sup> NPS 2003.
- <sup>66</sup> NPS 2005.
- <sup>67</sup> Keeton 2005.

